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Arbor and Wild Life Day

Louis Agassiz Fuertes

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BULLETIN TO THE SCHOOLS

VOLUME 42 MARCH 1956 NUMBER 7

THE UNIVERSITY OF THE STATE OF NEW YORK

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Convocation Date Is May 4

THE 88TH CONVOCATION OF THE BOARD OF REGENTS AND THE inauguration of Dr. James E. Allen, Jr., as Commissioner of Education and President of The University of the State of New York, will take place at Chancellors Hall in Albany on May 4, 1956.

COVER: Ruby-throated Hummingbird, from a painting by Louis Agassiz Fuertes in *The Birds of New York State*.

THE UNIVERSITY OF THE STATE OF NEW YORK
BULLETIN TO THE SCHOOLS

Issued monthly during the school year by the State Education Department

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The University of the State of New York

Bulletin to the Schools

VOLUME 42 MARCH 1956 NUMBER 7

Arbor and Wild Life Day

AT THE REQUEST OF THE FEDERATED GARDEN CLUBS OF NEW YORK STATE, the New York State Arborists Association and other interested groups, I am this year designating Friday, April 27, 1956, as Arbor Day, Bird Day and Wild Life Day. School administrators may, of course, select an alternate day if local circumstances warrant. The change to one particular day is made from the former three-day pattern in order to encourage a more significant statewide celebration and to emphasize how much our national prosperity depends on how wisely we understand and appreciate our natural resources.

I urge that in 1956 Arbor Day be observed by special programs stressing the practical and important aspects of conservation. Appropriately, the observances can emphasize our concern for bird and animal life, inspire a love of nature and of country and call attention to the role that each individual can play in the great movement for the husbanding of our natural resources.

Through assemblies, classroom meetings, films, radio and TV programs and in many other ways, Arbor Day offers a splendid opportunity to stress again the great natural blessings which have been given in such abundance to our beloved land. To this end, I have asked the curriculum staff of the Department to prepare a letter of suggestions which I hope you will find helpful.

James E. Allen, Jr.
Commissioner of Education

Marsh Mystery

Swamps Provide Homes for Many Plants, Animals

By
E. M. Reilly, Jr.
Curator of Zoology
New York State Museum and Science Service

AMERICAN BITTERN on nest in camouflage position

Places of mystery; dank, often dark, hard to penetrate and sometimes feared for quicksand traps, disease-bearing insects, hidden animal lairs and noxious odors, our marshlands are important assets with much that is beautiful and utterly fascinating. More than one acre in every hundred of New York's diverse countryside is a swamp of some kind: 381,600 acres of wildlife refuge and beauty.

We have almost any kind of swamp that can be named; shallow and deep inland fresh water, shallow and deep coastal fresh water, shrub swamps, wooded swamps, bogs, salt flats and regularly flooded salt water marshes. They exist along the edges of our many lakes, high in our mountains and bordering our rivers and streams to the very sea.

The wooded swamps are our most common type, with red maples, elms and cedars predominating. Shrub swamps with heavy growths of alder, buttonbush and dogwood cover more than 54,000 acres of State land. The shallow and deep fresh-water marshes overgrown with cattails, bulrushes, arrowheads, reeds and wild rice spread over some 68,000 acres; near the coasts these swamps are filled with giant reed, threesquare and pickerel weed as well.

Our 20,000 acres of bogland are resplendent with growths of heath, sedges, sphagnum moss, pitcher plants and an amazing array of lesser plants. In contrast, our salt marshes are covered mainly with salt marsh cord grass: 12,000 acres of rippling gray-green. Our scant 1,000 acres of glaring white salt flats scattered along the 600 coastal miles of Long Island bear clumpy growths of grayish and brownish-green salt grass, glasswort and seablite.

Under lowering gray skies, surrounded by brightening autumnal colors, our marshes furnish food and rest to many thousand wayfaring birds. Ducks, geese, curlews, rails, sandpipers, snipe, yellowlegs, herons and plovers feed on the surface and along the edges; thrushes, spar-

LEAST BITTERN hunting food

GREAT blue heron and nest

rows, warblers and blackbirds eat of the bounty from the herbs, shrubs and trees growing in the swamps. The marshes are havens to these migrants not merely because of the abundant food and shelter, but because man generally shuns these areas. Even in the hunting seasons very few men penetrate the further corners of our marshes for game; the going is difficult, the quarry elusive and the cover thick and abundant.

With the cold approach of winter we can investigate these wet lands more easily over the frozen surfaces, yet often only the trapper will bother. In the shelter of the dense shrub growths of a winter marsh, the scattered, lingering robins and bluebirds may be found. A song sparrow silently feeding on the yet abundant seeds from stalks waving free above the icebound muck and water will be holding back his salutatory song for the advent of spring. Winter wrens, chickadees, nuthatches, brown creepers, occasionally a hardy redwing and more rarely a myrtle warbler will cling to the food and shelter offered by shrub swamps in particular.

Spring unfolds myriad wonders and colors in the marshes; the air and waters pulse with life and sound. The amphibians have dug their way out of their cold muddy winter beds and often before the last ice has melted test their voices, hesitantly in the daytime and with deafening resonance at night. The song sparrow sings with increasing vigor and the robin forsakes his shelter to carol and strut on our lawns — and to be hailed as the first robin of the year. White-throated sparrows become abundant and start their never-ending call for "poor sam peabody . . . peabody . . . peabody."

Green herons and great blue herons appear commonly along with their cousins the least and American bitterns. A sharp eye will pick out the skulking sora, perhaps a Virginia rail and other shore and mud-flat birds among the flattened brown and shiny new green shoots of the cattails and reeds of the swamps. Certainly no one can miss hearing the harsh but joyous conk-a-ree call of the now ubiquitous redwinged blackbird while the repeated calls of the masked yellowthroat, though less strident, are noticeable.

The northbound waterfowl are using the marshes as they did in the fall, but now the plumage is more brightly colored.

GREATER yellowlegs

NEST AND EGGS of the American bittern

SORA RAIL'S nest out in the marsh

The brilliant colors of the foliage are not to be seen in the leaves of the trees, but gathered in the blossoms of the moisture-loving swamp plants. If one can disregard such prosaic things as wet and muddy footgear, a journey into most of our swamps during the spring will repay our discomforts many fold in beauty. Our ladyslippers, unable, because of their showy blossoms, to elude grasping and plucking hands in the more accessible wet lands, survive in safety and colorful numbers deep in many swamps. Protected by manmade laws against picking, they still strug- for survival against man's continuing efforts at draining marshlands.

To the music of the chorusing frogs, pumping bitterns and defiant caroling of male birds setting up their nesting territories, the marshes settle down for a summer of productivity. The discordant hum of mosquitoes is heard. The tremendous number of these pests bred in the still waters is halved again and again by natural enemies in the swamps so that very few get as far as a mile from the water. Dragonflies and damselflies in assorted sizes and colors patrol the air close to the surface; numerous phoebes, yellowthroats, wood pewees and assorted vireos and warblers cover the higher air; top-minnows, whirligig beetles, frogs, toads and salamanders search the waters for the mosquito in all its forms. In summer many birds nest in or near the marshlands because of the abundant food produced and the shelter available.

The loud repeated cow-cow-cow call of the pied-billed grebe may be heard in any marsh where growths of cattail, crowfoot and eelgrass occur. Its nest, half floating, half supported by rushes or reeds, may bear as many as nine eggs carefully covered with vegetation each time the parent bird leaves the nest. The young are able to swim immediately after hatching and paddle in close-knit groups after the parent bird or

ONE-DAY-OLD American bittern

ride on the mother's back in grand style. Ducks prefer the more shallow marshes for nesting; though few species nest in New York, great numbers of mallards, black ducks, blue-winged teals and wood ducks are raised in our marshes each year.

Nearly every marsh has its attendant group of herons; the large and stately great blue, the less autocratic and more timid green, the small and seldom noticed least bittern, and the much heard but seldom seen American bittern. Stalking sharp-eyed and sharp-billed through the shallow waters, flapping ponderously in the air or perched sedately at the top of a tall dead tree near its bulky nest, the great blue heron is an unforgettable bird. The crested and metallic-hued male wood duck sails gracefully through the waters of the wooded swamps while his mate broods the eggs in her nesting hole sometimes 15 or 20 feet above the water. If the nesting hole is too high from the water the young wood ducks are carried down in the mother's bill.

The Virginia rail may be seen and heard in any swamp throughout the State, while its close relative, the sora, nests mainly in the fresh-water marshes of the interior. Able but reluctant to fly, these rails prefer to escape by dodging through the reeds and grasses; when cornered by a group of people they may be picked up and observed in the hand. When handling these birds it soon becomes evident that the plumage accounts for most of their thickness and that their bodies are quite "thin as a rail."

Among the giant reeds, bulrushes and salt water cord grass nest numerous species of birds. The seaside sparrow lives up to his name, the long-billed marsh wren builds two or three nests in the reeds only to have his mate disregard them and build another in a site of her own choosing. Rails, red-winged blackbirds, Savannah sparrows, sharp-tailed sparrows, swamp sparrows and many other small birds pick the coastal marshes as their nesting grounds.

The rubbled houses of the muskrat poke through the marsh waters all over the State, the squared wake of the hard-working beaver, the sleek wake of the otter, the swift movements of the mink and the rapid darts of the weasel give evidence of abundant mammal life. Turtles, snakes, worms, bacteria, all forms of life are gathered in the dim recesses of our marshes, often ignored and fighting a losing battle against the destruction of their homes by drainage.

Drain the swamps, pour oil on their untroubled waters, burn the brush, cut down the trees — they are the breeding grounds of pests, vermin, evil-smelling gases, noxious odors and disease; such has been man's opinion of marshes. Not one of the charges is true; *natural* marshes are one of our assets. Man can truly level all those charges at his garbage heaps and dumping grounds — he often defiles the swamps by dumping his refuse in them and often the distant marsh takes the blame for the products of his nearby dump heaps. We could use even more marshes in New York State; more refuges for migrating waterfowl, more havens for vanishing wildflowers and animals, more reservoirs of beauty and wonder.

YOUNG marsh hawks in their nest at marsh edge

A TREAT FOR TWO — Dolly Allen offers a peanut to one of the friendly chickadees at Sapsucker Woods.

Sapsucker Woods

New Cornell Bird Refuge Used by Many Species

By
ARTHUR A. ALLEN
Professor of Ornithology Emeritus
Cornell University

TWO MILES AS THE CROW FLIES NORTHeast of the Cornell campus, there is an intriguing woodland of about 130 acres that we call Sapsucker Woods. It was so christened in 1909 when the author and Louis Fuertes, accompanied by Francis Harper and James Gutsell, discovered that the yellow-bellied sapsucker nested there together with Canada warblers and northern water-thrushes. This gave it the distinction of being somewhat Canadian and different from the Cornell campus and adjacent woodlands. We also found ruffed grouse there that Sunday morning and pileated woodpeckers and red-shouldered hawks and horned owls and many other unusual birds that made us want to return.

Through the ensuing years we returned many times as have successive "generations" of Cornell students, and we have always found it rewarding. The Arthur Lanes, now the caretakers, moved in and tamed the chickadees and the woodland gradually became a mecca for bird classes. Graduate students in ornithology selected research problems on the birds nesting there.

As other woodlands nearer the campus fell before the axe we began to worry for the safety of our sapsuckers and waterthrushes and Canada warblers. We began looking about for a way to save the area for the university so that we could have it set aside in perpetuity as a bird refuge. It was not until 1954, however, that this plan was fully consummated by a generous alumnus Lyman Stuart, who interested his family in giving the woods to the university as a memorial to his father and uncle. The Stuarts also financed three miles of chain link fencing to surround the woods and provided an endowment for maintaining it. The Walter Heasleys generously added 20 acres of their woodland to round out the Stuart gift and make the Sanctuary a complete unit.

In addition to the fence surrounding Sapsucker Woods, many improvements are planned or have already been initiated to make the area attractive to as great a variety of birds as possible, as well as to visitors. At the north end, for example, where a building will be placed, about 10 acres of water have been impounded to form a partially wooded pond and already wood ducks, blacks, mallards and pied-billed grebes have moved in and herons, bitterns and rails are looking it over. About four miles of trails have been constructed which will serve for fire protection as well as for making the area more available for class use and

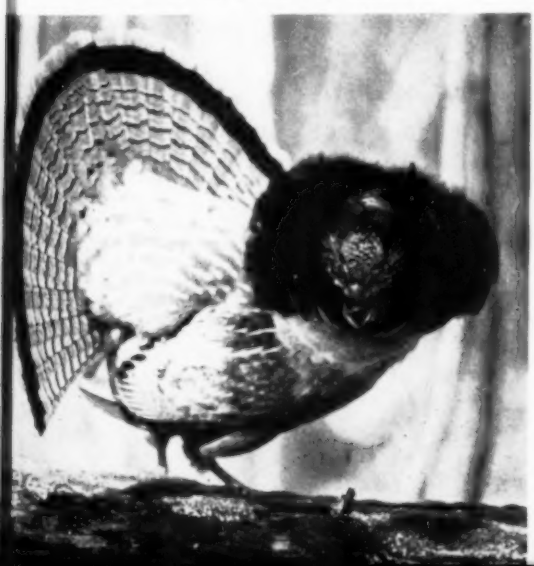
more desirable for those birds that prefer the edges so created.

A fireproof, ranch-type building 150 feet long by 50 feet wide has been designed with a connecting observation room 25 feet long by 50 feet wide at the edge of the pond. This room will have picture windows overlooking the water on the west and bird feeders on the southern woodland side. The plans provide for offices, laboratories and an aviary for studies in bird behavior, as well as for a sound room, dark room and a library and reading room. It is expected that construction will start this spring. A seven-ton memorial boulder has been placed among ferns and hemlocks near the gateway to the woods. Here also there will be a small open-air classroom facing the bird feeders.

There is considerable open land north of the pond which belongs to the university and about 20 acres of this has been enclosed within the fence to make a home for the bobolinks, meadowlarks, Henslow's sparrows and other field birds. A part of it may be planted to groups of desirable trees that will make the area more attractive to certain birds not at present represented in the list of 80-odd nesting species. At one corner of the large pond, for example, we plan a thicket of balsam and spruce for magnolia and Blackburnian warblers. Within the woods, near one of the trails, a depression 75 by 25 feet has been bulldozed where it is hoped to start a sphagnum bog and perhaps bring in Nashville warblers, which do not nest there at present, as well as pitcher plants, sundews and orchids.

NAMED FOR HIM — A sapsucker himself at the door to his home in Sapsucker Woods

READY FOR DRUMMING — This ruffed grouse displays all his finery before starting his drumming dance.



In accepting the gifts from the Stuart family, the Cornell trustees not only set aside the area in perpetuity as a bird sanctuary but they also set up the Laboratory of Ornithology as a separate department in the university. In its new role the Laboratory of Ornithology is not attached to any college or department but has two directors, Professors Arthur Allen and Paul Kellogg. The laboratory will not supplant any of the ornithological teaching or research in other departments of the university, but will supple-

SETTING THE STAGE — Fastening a microphone near the drumming log on which a ruffed grouse will perform his drumming, while cameras click from the blind at the rear

ment their work with additional facilities as well as carrying on its own projects, for which it has gained an enviable reputation through the years, and it will provide a scientific, educational and cultural center for the study of living birds.

The Sapsucker Woods has wonderful possibilities for intimate bird studies and it is most satisfying to know that the Laboratory of Ornithology, and the Library of Natural Sounds, will now have a permanent building and that none of the studies to be made must of necessity have economic implications. Songbirds and game species will have equal consideration.

Cover Leaflets Available

Single copies of the colored cover picture of the Ruby-throated Hummingbird, with descriptive account, are available in leaflet form from the New York State Museum, Albany.

The Arbor and Wild Life Day number of THE BULLETIN TO THE SCHOOLS *is the only one devoted annually to natural history and conservation interests.*

Spiders: the Children of Arachne

Web-spinners Related to Famous Fable of Classical Times—Weavers Have Interesting Habits

By
DONALD L. COLLINS
State Entomologist
New York State Museum and Science Service

ARACHNE . . . " NON ILLA LOCO NEC origine gentis clara, sed arte fuit. . . . Nec factas solum vestes, spectare iuvabat tum quoque, cum fierent; tantus decor adfuit arti . . . scires a Pallade doctam." (She was famous not for place of birth nor for birth itself, but only for her skill . . . It was a pleasure not alone to see her finished work, but to watch her as she worked; so graceful and deft was she, you would know that Athena herself had taught her.)

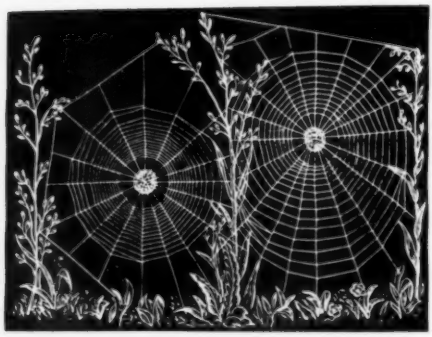
Thus did Ovid (*Metamorphoses*, Book VI) set the stage for the remarkable story of Arachne, the Lydian girl who was so proud of her skill in the arts of spinning and weaving that she dared challenge the goddess Athena herself to a weaving contest.

She dared go even further: she chose as her subject some of the more scandalous escapades of Athena's associate gods and goddesses, and she depicted them so skillfully and unmistakably that the enraged goddess took her shuttle and ripped Arachne's tapestry to shreds. Poor Arachne, in fright and despair, hanged herself. Athena, taking pity on her, loosened the rope and changed her so that " antiquas exercet *aranea* telas:" — " as a spider she still exercises her weaver's art."

So let us think of this weaver of nature's most perfect tapestries as Aranea, transformed from Arachne, for these names are accepted by scientists as proper designations. As new and different kinds were found and described, new names were added, such as *Epeira*, *Argiope*, *Theridion*, *Lyssomanes* and

Ariadna — names with a classic beauty and background which should lead us to search in the creatures themselves for the qualities which inspired them.

There is, for instance, Argiope: *Argiope aurantia*, the Golden Orb Weaver. To see the perfect orb of her web, arranged with geometric precision between the tall goldenrod and the purple asters, and festooned with dewdrops glistening like pearls in the sunrise, is to see one of the most beautiful examples of the handiwork of wild creatures.



Typical orbwebs of Epeira strix

Argiope is, herself, a beautiful creature and most interesting to watch as she goes about her daily routine. Sometimes an inch or more in length, she has a basic color of black; along each side are broad bands of bright golden orange or yellow, and there may be light colored bands also on the legs. *Argiope* is especially easy to study since, unlike some of her relatives which stay hidden most of the time or come out only at night, she is likely to stay in the center of her web right through the hottest, sunniest days of the late summer. Her web may have a diameter of two feet and is usually placed across the right-of-way of grasshoppers and other jumping and flying insects.

To start a typical day with *Argiope* (or any other orb weaver such as *Epeira* or *Micrathena*) we might find her starting a new web to replace one that had been torn down by some blundering wanderer of the night. If her web was only a little damaged, she would probably restore it by some skillful patching. But if she started all over again she would have to begin with the framework.

She lays the foundation or first dragline in one of two ways: From a "selected" starting point she may be able to go around the entire circumference of her future web on foot, in which case she will spin out a dragline as she goes, fastening it at intervals to the material over which she walks, until it becomes the outer frame line of the orb. Or, if the space is large or not readily circumnavigated directly, she may spin out an initial bridge line to be carried by the wind until it hits and sticks to an object a short distance away. If she does it this way she will then start out over it spinning reinforcing threads as she goes and may go back and forth several times, weaving in a strand of the cable each time. Or she may not strengthen it completely until, as she adds radii and the spirals, she seems to detect that strengthening the original framing line will be necessary.

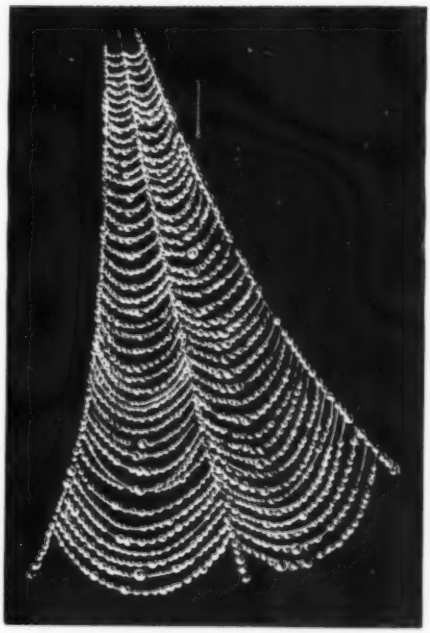
From some point on the first horizontal bridge line she makes an attachment and then drops down, paying out thread as she goes, until she touches the ground or some intervening object. There she fastens the end of the thread and starts back up, spinning another thread but holding it away from the first line with her hind feet. She may take this thread up to the junction of the dropline with the supporting cable and back along the cable toward its origin. Before she reaches the origin she stops and after pulling taut the line she has been holding, she fastens it. This pulls the original dropline out of line a little and the triangle thus formed becomes the framework within which the full orb will be spun. Sometimes more frame lines are added so that the framework is a trapezoid or some other polygon, and there may be other modifications due to the exigencies of the site conditions.

The radii of the orb are fashioned next by the same fundamental techniques as the making of the framework: dropping a line from the top cable to the bottom frame line, then going back to the center and carrying a loose line to another point on the frame, tightening it so that it makes an angle from the first, and so on. We cannot take time to follow this little engineer through the laying down of the

spiral and other features of the completed snare, but we can see enough to marvel at her engineering skill, and we can come back later to admire the finished product. She may also very obligingly show how deftly she packages her dinner in a thick silk wrapper when a grasshopper becomes enmeshed in the web — an act that is so easy to observe that we need not describe it here.

Instead, we shall look up some of *Argiope's* relatives, which, though not so beautiful, nevertheless have habits and behavior patterns that are just as interesting.

There is *Theridion;* whereas *Argiope* sets a snare for flying insects, *Theridion* is out to get the pedestrians. *Theridion's* snare at first glance seems to be a maze or tangle of threads without any definite system, but on closer inspection the basic plan of a typical *Theridion* web appears to be a tent or hammock supported from above by trusses and braces and anchored by vertical threads to the ground. These vertical threads are more than merely stays or guy wires; they are the essential part of the trap. The spider smears the lower ends of these lines with sticky glue and makes them so taut that when they snap under a strain they contract like elastic bands. If some unwary beetle wanders by and brushes against one of these special threads, the chances are it will stick to him. In his effort to escape he is likely to strain the thread so that it snaps and jerks him up off his feet. As he swings about and contacts other sticky strands they, too, may break off and he now finds himself hopelessly entangled, suspended in mid-air. *Theridion* may sit by until the captive has become more or less helpless in his struggles, or if it is a large victim she may help things along toward the inevitable conclusion by running down and biting him every once in a while. Eventually she will go over to one of the supporting threads, haul in



Section of the dew-laden orbweb

the line, give the prey a final nip and take him off to some quiet nook in her tent to enjoy her meal in privacy. There are well-supported observations of our common *Theridions* having, in this way, subdued and lifted mice, snakes and other small animals.

Just as some but not all of a gifted person's children may appear to inherit that person's ability along certain lines, so not all of Arachne's descendants have inherited her weaving skill. There are many that may spin a thick mat, or enough silk for a tubular retreat, but otherwise forage far from their tents without even laying down a drag line. These include *Lycosa* the Wolf, a vagrant wanderer; *Misumena* the Crab, shaped like a crab and as brilliantly colored as the flower heads in which she waits in ambush for her prey; *Dolomedes* the Fisher, which dives under water to catch small fish; *Oxyopes* the Lynx; *Phidippus*

the Jumper — bright-eyed, bright colored, and quite a clown in its behavior.

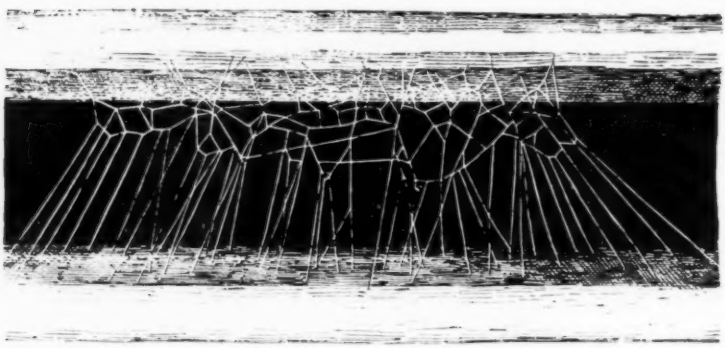
It would hardly be fair to mention all these fascinating characters without at least a passing reference to the only villain among them, *Latrodectus mactans* — the Black Widow. This is the only one that need be feared of all the hundreds of species that occur in New York State. It is not uncommon in favorable locations on Long Island and may be found occasionally in other parts of the State. It spins a a coarse tangled web in obscure dark corners, such as recesses in woodpiles, stone piles and rubbish heaps, or under loose boards, in corners of outbuildings, holes in foundations and the like. A full-grown female Black Widow has a shiny jet-black body about the size of a pea, with a bright crimson hourglass-shaped spot on the under side. The male, as in most spiders, is much smaller and less conspicuous.

The above merely suggests the endless variety of forms and the astonishingly complex behavior patterns that characterize the Araneae.

To learn more about them, and as a guide to personal observations and study, there are several good books that might be consulted. Among them are two that were especially helpful in presenting some of the information given above, namely, *American Spiders and their Spinningwork*, by Henry C. McCook* (three volumes, published in 1889), and *American Spiders* by Willis J. Gertsch. *How To Know the Spiders*, by B. J. and Elizabeth Kaston, and *The Spider Book* by John Henry Comstock are also readable and useful guides to knowledge about spiders.

One should certainly read about *Mastophora*, the bolas thrower, which actually swings a weighted line at a prospective victim and lassos it; also about the spinning process which should take on a new interest in the light of modern techniques of extruded plastics. We find that the basis of this most modern of industries goes back to Arachne. " Scires a Pallade doctam." Athena herself must have taught us also.

* The figures of webs, used in this article, were taken from McCook. The drawing of Arachne and Athena was made by John Gallucci, after a frieze in the Forum of Nerva, in Rome.



The meshed snare of Theridion, *thickened at the top and supported by silken trestles*

Geologists Conserve Our Minerals

Wise Use of Existing Supplies for Best Advantage of All. Part of Scientists' Work

By
JOHN JAMES PRUCHA
Geologist
New York State Museum and Science Service

TO MANY YOUNGSTERS THE COLLECTING of rocks and minerals is proving a fascinating and educational hobby, which satisfies both the urge to get out into the open and the love of acquiring and handling things of natural beauty. Commonly the interest in collecting develops from a quick curiosity aroused by a bright shiny pebble or an unusual shaped rock found accidentally during play or routine activities. Occasionally this early interest in rocks and minerals may develop into a broader interest in the materials and processes which constitute and shape the outer part of the earth, and the youngster may strive to make more of his hobby than merely acquiring additional specimens.

But without some sort of help in nurturing an early concern for collecting rocks and minerals, it is seldom that a youngster's interest goes much beyond or persists much longer than that of the youthful collector of matchbooks or pictures of big league baseball players. The teacher of general science or earth science can do much to develop an inquisitiveness about the geologic principles which explain the nature and distribution of the rocks and minerals which find their way into the collections of eager youngsters. It is in just that way that many geologists were first introduced to the science that became their lifetime profession.

In recent years the great amount of publicity given to the nationwide search for valuable uranium deposits has focussed attention as never before on the geologist, who commonly is depicted as a colorful character roaming the hills with Geiger counters and living for months on a diet of beans and dried fruits. At best such a concept is an absurd oversimplification of the real picture and would hardly lead a serious youngster to consider a career in geology as a natural sequel to a rocks and minerals hobby. The science teacher can render a real service by presenting to the student a true picture of what a geologist is and what his profession contributes to the general welfare of the Nation.

It is the aim of this article to discuss but one of the many facets of the geologist's work: his role in the conservation of mineral resources. It is hoped that what is written here will improve the teacher's own understanding of what a geologist is and does, and thereby put the teacher in a better position to guide the student in developing latent curiosity.

Conservation of our mineral resources means the wise use of existing supplies to the fullest advantage of our whole society. Unlike other natural resources — such as forests, soil and wildlife — minerals are irreplaceable. Hence, it is especially important that they be used intelligently and efficiently so that maximum benefit may be derived from them before ultimate depletion.

GEOLOGIST examining Adirondack pyrite deposit which is being evaluated as a possible source of sulfur to supplement existing supplies on the Gulf Coast

In the intelligent use of our mineral resources the geologist plays a key role, though one which is little understood by the average citizen. Here in New York State, where the production of oil and gas, garnet, iron, zinc, talc, titanium, cement, salt, limestone and dozens of other mineral commodities comprises a major contribution to the economy and welfare of the State and Nation, the geologist is an important advocate and practitioner of sound mineral conservation.

A geologist essentially is a student of the earth's crust, the outer part of which is displayed here and there as firm bedrock underlying a mantle of soil and weathered rock material, or is accessible by drilling and excavation. The geologist's science, called geology, is relatively young compared to chemistry, physics and mathematics, and it is a "borderline" subject in that it draws heavily upon the knowledge of other physical sciences in the formulation of its own principles and methods. Today's geologist, however, is far removed from the "naturalist" of years ago; he is observant, imaginative and well trained in the disciplines of both laboratory and field.

Fundamental to a proper use of our mineral resources is a thorough knowledge of our geological environment. This is gained principally by intensive long range programs of geologic mapping. A geologic map is one which shows what kind of rock occurs where, and it indicates by the use of symbols the patterns of folding, fracturing and other types of deformation which have been superimposed on the earth's crust. In a sense, a geologic map provides an inventory of rock types, and it serves as a reference frame on which to base the search for specific ore

bodies or oil and gas occurrences. The meticulous, and often arduous, field work which goes into the making of a geologic map, along with correlative laboratory studies, commonly leads to the formulation of principles which aid in the search for new mineral deposits, or in the intelligent exploitation of known ones.

In New York State, programs of fundamental geologic mapping are being carried on by the Geological Survey of the State Museum and Science Service, the United States Geological Survey, several universities and to some extent by mining and petroleum companies. Much work remains to be done, but responsible people are becoming ever more cognizant of the importance of this type of work in the conservation of our mineral wealth.

Through a knowledge of the distribution of rock types gained from geologic mapping, and by the use of well-established principles governing the formation and occurrence of valuable mineral deposits, the geologist is able to classify land areas according to the probabilities of finding certain types of mineral deposits. As an example, the Adirondack region is underlain by ancient crystalline rocks not suited to the occurrence and accumulation of gas and oil, so that the geologist need not spend time, money and energy in the futile search for those commodities in that region. Similarly, the geologist knows that there is no reasonable possibility of finding magnetic iron ore deposits in the younger flat-lying rocks of the Allegheny Plateau in southwestern New York State, though he may hope to find oil and gas. On the other hand, relatively little is known about the distribution of uranium minerals; hence, no geologic terrane may be ruled out absolutely as a possible place of uranium mineralization. A knowledge of what kind of rocks occur where is an essential tool in the development of our mineral resources.

Occasionally in the course of routine geologic mapping the geologist may discover sizeable concentrations or deposits of some rock or mineral for which no economic use had been known previously. Such an event challenges the engineer and industrialist to develop one or more uses for the commodity — perhaps as a substitute or supplement for other commodities, perhaps for some brand new purpose. Many cases of this type have occurred, but an excellent illustration right here in New York State can be cited.

Some years ago a geologist mapping a part of the Eastern Adirondack Mountains for the State Museum and Science Service discovered a large, relatively pure body of a calcium silicate mineral, called wollastonite, near Willsboro in Essex County. Through publication of his report the deposit became known to the public and ultimately came into the hands of Godfrey L. Cabot, Inc., a company dealing principally in the manufacture of carbon black. The Cabot company spent thousands of dollars experimenting with the wollastonite ore and has recently developed several worthwhile uses for it, including pigments and ceramic materials. Future development of the wollastonite for use in new products and partly in place of commercial talc will increase our mineral reserves and conserve other commodities which it might replace or supplement.

In geology, as in other sciences, the development of new ideas generally proceeds from the known to the unknown. Thus, in the search for new mineral deposits it is usual for the geologist to look for other areas in which the geologic conditions of a producing area are duplicated in some degree. The selection of such areas for exploration must be based on a fairly thorough understanding of the geology; it depends upon the information made available by geologic mapping.

GEOLOGISTS examining limestone in road cut during survey of limestone resources

Recent drilling for natural gas in the Catskill Mountains is based upon such extrapolation of knowledge and experience. Should current exploration activity for gas in that region prove successful, our reserves of that important mineral commodity will be increased, and resources that would otherwise be neglected will be conserved for future use.

All mineral commodities must meet certain chemical and physical specifications before they are suitable for use. Iron ore, for example, has little or no value if it contains too much silica or phosphorus, and garnets which lack appropriate fracturing characteristics are practically worthless as abrasives. It is important, too, that a given mineral deposit be of sufficient size to offset the initial cost of bringing it into production, and it must be situated advantageously with respect to transportation, labor and markets.

The proper evaluation of all these factors is not the sole responsibility of the geologist, but he plays a major part. It is usually his job to determine the size of a potential ore body and to plan a system of sampling which will reflect the true average composition of minable quantities of the ore. In the laboratory he may determine exactly what minerals comprise the ore — including impurities — and the important textural relationships of one ore mineral to another. In short, the geologist often has the prime responsibility for determining whether or not a given mineral deposit can actually be considered a part of our mineral reserves.

A survey of the limestone resources of New York State is now in progress by the State Museum and Science Service, in cooperation with the State College of Ceramics, and can be used to illustrate the geologist's part in the proper use of our mineral wealth. The great belts of limestone and dolomite trending east-west across New York State, along the St. Lawrence Lowlands, and in the Hudson River Valley are the areas of potential economic deposits of stone suitable for use in portland cement manufacture, steel

furnaces, agriculture and roadbuilding. But much of the limestone and dolomite is of no value for any of these uses. Each particular use demands specific chemical and physical characteristics, and it is up to the geologist — in cooperation with the chemist and other scientists — to determine where certain types of stone may be found within the large belts, how much there is and how good it is for certain uses. The problem is worked out by very detailed geologic mapping, careful field observation and description of the rock layers, and proper sampling and analyses. Such studies have already helped establish a new cement manufacturing company in the Hudson Valley.

Just as important to mineral conservation as the discovery and development of new ores bodies is the efficient exploitation of existing deposits. The responsibility for the actual extraction from the ground of ores and petroleum products is generally the engineer's, but he is dependent upon the geologist for necessary information on the size, tenor and configuration of the ore or petroleum reservoirs. Detailed geologic mapping of mine workings and carefully planned exploratory drilling ahead of the actual mining may provide the engineer with the information necessary to assure efficient removal of maximum quantities of ore. Modern mining practice based upon sound geologic studies has largely done away with the old way of robbing a deposit of only the high grade ore and leaving behind forever the lower grade, less profitable ores. Instead, the lower grade parts of an ore body are "sweetened" by the high grade ore to produce a mixture of acceptable composition. Practical conservation practices of this type have greatly deferred the ultimate depletion of many ore bodies.

Increasing populations and accelerated rates of industrial expansion throughout the world make it imperative that our mineral resources be developed and exploited wisely. As the more conspicuous deposits are used up, it becomes increasingly difficult to find new supplies, and the geologist becomes more necessary than ever. True conservation of our mineral resources — the wise use of existing supplies to the fullest advantage of our whole society — is essential to improving our way of living.

Conservation Week in Tully

By Floyd E. Carlson

The village of Tully, set in the midst of rich farming land surrounded by rolling partly forested hillsides, was surprised one morning when a truck with a huge load of sand, drove up and dumped its load of sand right on the corner of the busiest intersection in the heart of Tully. From this spot in front of Hall's Gas Station on Route 11, next thing folks saw were members of Tully

Mr. Carlson is Associate Professor of Forest Extension, State University College of Forestry in Syracuse, chairman of the Natural Resources Council of Onondaga County, and for the past nine years producer of programs on natural resources and forestry for the Empire State FM School of the Air. His Current FM series for the schools is called "Tree Time," heard on a network of 23 stations.

Grange No. 617 climbing all over this high mound. First they divided the pile into two parts. On one side there gradually appeared sod and trees, on the other the effects of soil erosion following fire and the killing of the protective cover of shrubs and trees. As the exhibit neared completion, the grangers erected a sign in the background reading, " Help Nature Help You," the theme of Conservation Week; and " Prevent Forest Fires."

This exhibit, right on Route 11, about 20 miles south of Syracuse, attracted large numbers from out of State, and many from the Southern Tier of New York heading for the Adirondacks, and certainly must have impressed them with the truth and importance of the seven words on the sign. So here at the curb, travelers could catch a lesson on forest fire prevention while they waited for a red stoplight to change to green. Some intrigued motorists turned off on side streets, came back for a second look, and to get a picture of this fine work. This was the beginning of a considerable stir of activity among the 1,000 residents of Tully as they began to get ready for Conservation Week proclaimed by Onondaga County and the City of Syracuse to be May 1–8 last year.

About this time the Tully Central School, where the principal is John D. Crosley, started tuning up for the upcoming Conservation Week. The art teacher, Mrs. Charles D. Silvernail, followed up a poster contest suggestion for the grade school classes. Soon some 70 pupils were spreading paint on cardboard to tell a conservation story. Art students in high school joined in too, but the contest feature was limited to grades 4–8.

About this time also, the teachers of English took up Conservation as a theme in the eight English classes in high school and soon around a hundred and sixty essays were coming from the pens of boys and girls. For many of them it was their first serious thinking about the significance of the natural resources of water, soil, forests, wildlife and recreation areas.

As the Grange exhibit took form, and the poster and essay conservation contests got underway at the Tully Central School, more evidence of conservation interest showed up in store windows around the village. Across the street from the Grange exhibit, in Ramsey's I.G.A. Store, the Cub Scouts with their Den Mothers were busy making an exhibit of birdhouses, contour farming, forest fires and posters. Nearby the Tully Food Locker had a display made up of seedlings, moss, a mirror for a lake and little ceramic animals and birds that was also a great attraction.

The Baptist Church of Tully got out a Conservation church calendar when that week came around.

Backing the Conservation Week idea in the Village of Tully was *The Tully Times*, and the persistent interest of Mrs. Marion McQueens, its editor and business manager.

A few days before Conservation Week arrived, judges for the poster contest selected 10 of the best posters and placed them together in the window of Wortley's Drug Store. Here the public was asked to cast a ballot in the box in the drug store for their choice of the 10 posters. To be fair to each contestant, the public was asked to vote by numbers because no names appeared on the posters. Other posters, not selected by the judges, were placed in other store windows around the village.

While the posters were being voted upon, the conservation essay contest entries were looked over. The teacher in charge of each English class selected the best essay in his class and then a group of teachers selected the best three from among the best of the classes. The Thursday issue of *The Tully Times* for April 28, 1955 was volume 73, number 18. It

carried a big headline CONSERVATION WEEK MAY 1–8. And just below in three separate columns were the essays "A" "B" "C" capped with a smaller headline reading: ESSAY CONTEST — VOTE FOR ONE AT WORTLEY'S BY MAY 3RD.

And so by noon on May 3 the village folks had been in to drop their ballots at Wortley's. Students from the Tully Central School had come in groups to look at the 10 best posters in Wortley's window and cast their ballots.

With copies of *The Tully Times* before them, the townspeople scanned the essay titles, "Soil Conservation," "Conservation of Our Soil and Water," "Why is Conservation Needed?" and made their choices.

On Wednesday afternoon of Conservation Week, there was an assembly where movies were shown by Grover C. Pfeiffer of the Onondaga County Federation of Sportsmen's Clubs and a member of the Natural Resources Council of Onondaga County. His movies depicted many conservation activities carried out by the federation. After the movies, Mrs. McQueen announced the winners of the poster and essay contest and presented them with plaques from the Onondaga County Federation of Sportsmen.

Winner of the poster contest was a boy who put the words, "Prevent Forest Fires" in wiggly letters against an orange-red background showing a fire-scarred tree toppling before the flames. The simple but striking poster was done by Robert Jenks, a seventh grader who lives in the village.

In the essay contest a junior, Linda White, won first place; a sophomore, Delia Parker, was second; and Louis Currie, another sophomore, was third.

Recounting their Conservation Week experience, Mrs. Silvernail, the art teacher, said, "It made a nice project for me — I really enjoyed it!"

Mr. Crosley, the principal: "The school took Conservation Week in stride and everybody realized the worthwhileness of it. I think it did a lot of good. It is a thing that could grow if it were done over a period of years."

"Conservation concerns everybody. Most of us do not think about conservation because we never had to, but when it is called to our attention and we stop to think about it a bit, there are many aspects that affect you and me and everybody."

And how did Conservation Week come to Tully? This came about when the county and city committee for planning Conservation Week for Onondaga and Syracuse, met and decided to include a committee on neighborhood activities. The chairman was Charles E. Clift. Talking about Tully's participation, Mr. Clift said, "I first went to Mrs. McQueen, the editor of *The Tully Times*. As editor in a small town, Mrs. McQueen knew everybody. Mrs. Grace S. Raines, writer of the nature column, also became very interested; and between her articles and those of Mrs. McQueen, we were able to bring before the people in that section of Onondaga County just what we had to do for Conservation Week.

"I do not think too much credit can be given to Mrs. McQueen, the principal and the teachers of the school, the leaders of the Grange, and others who helped spearhead their different activities. Due credit should go to the Den Mothers and the Cub Scouts who did a wonderful job!"

Conservation Week for Onondaga County and the City of Syracuse this year will be May 6–12. Because of the interest in Conservation Week, it has already been established as an annual event for Syracuse and Onondaga County.

Presently, Conservation Week is being urged as a statewide activity. It is very likely that many schools will be joining to sponsor an Annual Conservation Week.

Do YOU Know the Lichens?

Fungus and Alga Combine for Their Mutual Advantage—Should Be Included in Every Field Trip

By
EUGENE C. OGDEN
State Botanist
New York State Museum and Science Service

WHAT IS A LICHEN? A LICHEN (pronounced lī′kĕn) is a dual organism composed of two distinct and dissimilar plants, a fungus and an alga, living close together to their mutual advantage. This is a type of relationship which allows both to live in situations where neither could exist alone. The fungus parasitizes the alga but in such manner that the alga continues to thrive within the protective moisture-absorbing fold of the fungus tissues. The alga manufactures food for itself and the fungus. There are numerous cases like this (we call it mutualistic symbiosis) in the biological world but only those between fungi and algae are called lichens. Having chlorophyll, they make carbohydrates from carbon dioxide and water, both of which are present in the air. The chlorophyll is only in the alga partner which carries on photosynthesis like other green plants. With the possible exception of a few tropical lichens, the fungus partner (which has no chlorophyll and cannot manufacture food from raw materials) obtains its nourishment from the alga. Thus a lichen in our area is never a parasite (which must obtain food from living material) nor even a saprophyte (which must use dead organic matter).

What do they look like? This is hard to answer in a few words because lichens vary in size, shape, color and habit. They range all the way from scarcely visible dots on rocks and tree bark to loose papery sheets over a foot wide or much-branched shrub-like masses several inches tall or even hanging streamers several feet long. The color is mostly ashy gray or greenish gray but ranges from white to black. Deep green, bright pink, brilliant scarlet, warm brown and sulfur yellow may all be seen on some parts of some lichens. Often the appearance is strikingly different between wet and dry individuals. When wet the hygroscopic fungus swells and becomes translucent

LICHENS are seen at all seasons. This is a foliose type called Parmelia *or paper lichen.*

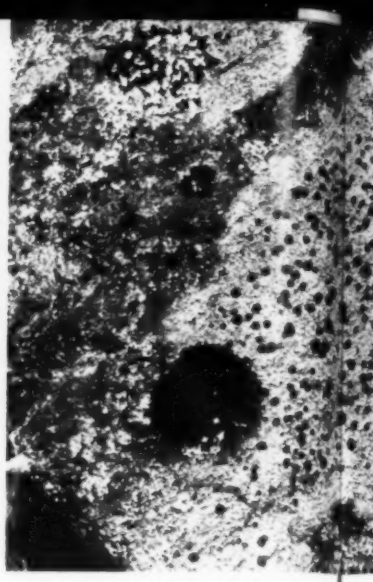
allowing the green color of the alga to show. Lichens are often described as: *crustose*, forming crusts on trees and rocks; *foliose*, like foliage or having thin broad papery structures; *fruticose*, upright like miniature shrubs; and *pendant*, hanging in threadlike streamers.

Where are they found? Throughout the world from the tropics to the polar regions, from sea level to frigid mountain peaks, on desert rocks and shady cliffs, on the ground, in the tree tops, a few even under water. They have been found on nearly everything having reasonable permanence: rocks, tree bark, soil, wood, bones, leather, iron, bricks, mortar, fungi, mosses, charcoal, tar, glass, linoleum, cloth, felt, rubber and even such transient substances as paper and animal droppings. They need no soil, but a foothold only. They are especially abundant on mountains -- also bogs, old burns, neglected roads and stream banks. Few survive near large cities because of air pollution; in fact, they may be indicators of amount of pollution, the large fruticose kinds disappearing first, the tiny crustose forms being the last to go. Lichens survive greater extremes of cold and heat than other living organisms, being found in polar regions where no other vegetation exists and on tropical desert rocks exposed to the noonday sun, depending on night dews for their moisture.

How can I learn to know them? It would be well to start with a picture book. Unfortunately there are not very many, and those mostly out-of-print. You might start with the pictures, many in color, of *Mosses and Lichens* by Nina L. Marshall although *The Lichen Book* by G. G. Nearing is by far the best book for the serious beginner. A very useful brief article is "The Lichen Clan" by J. W. Thomson. This is Bulletin No. 3 (Series No. 3) of the School Nature League, National Audubon Society. Excellent illustrated articles occasionally appear in popular journals such as "Lichens in Your Rock Garden" by R. H. Torrey in the April 1938 number of *Natural History*. "Lichens -- Small, but Important" by D. Butcher, *et al.* in the November 1941 number of *Nature Magazine* and "Lichens" by J. W. Thomson in the April 1949 number of the *Journal of the New York Botanical Garden*. The *Lichen Flora of the United States* by Bruce Fink is useful but tough going. For general informational reading, although not designed for lichen identification, there is nothing better than *Lichens* by Annie L. Smith. The serious student will find a wealth of material in scattered articles. One can learn to know most of the common foliose and fruticose lichens through pictures and descriptions. The crustose forms may require the use of a magnifier (hand lens about 10-power) which is a very useful aid in the study of all plants. After the easily recognized kinds have been learned it will be necessary to use a microscope in order to examine the spores and the alga types which can scarcely be seen at magnifications less than 100 diameters. Preparations for microscopic study are easily made. A small portion of the lichen is placed with a drop of water on the microscope slide. It is chopped fine with a razor blade and a portion of it crushed with the side of the blade or some other suitable instrument. The cover slip is now added and at 100× the internal structure is clearly portrayed.

How can one be sure it is a lichen? To be really positive about it one would make a microscopic examination to determine if the fungus threads enclose and form a connection with the alga cells. Sometimes fungi on tree bark resemble lichens so closely that microscopic examination is necessary, especially where fungi and algae are living independently

OLD STONE FENCES may sport many kinds of lichens. The conspicuous one here is Parmelia.

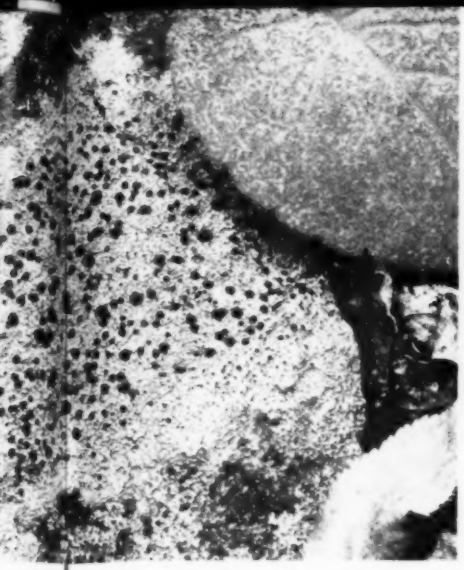


THESE BLACK DOTS are the f lichen.

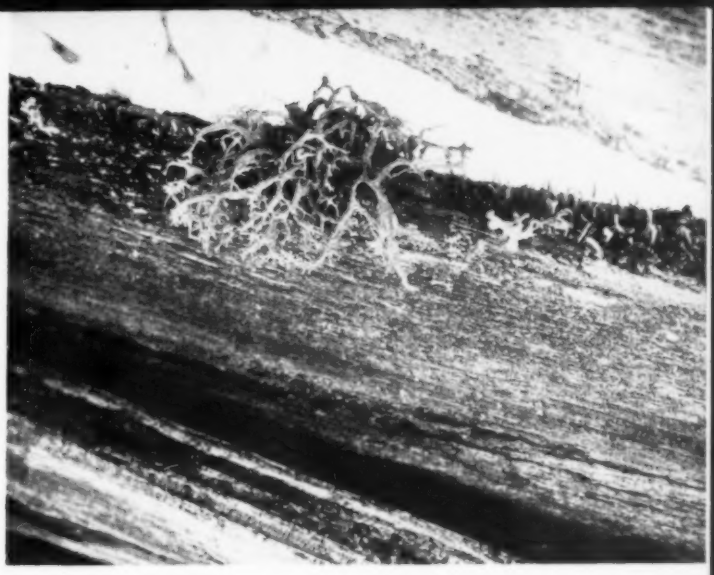
Lichen Portraits

PARMELIA *AND* USNEA *have a foothold on this slender tree trunk. The disklike bodies on the* Usnea *are fruiting bodies.*

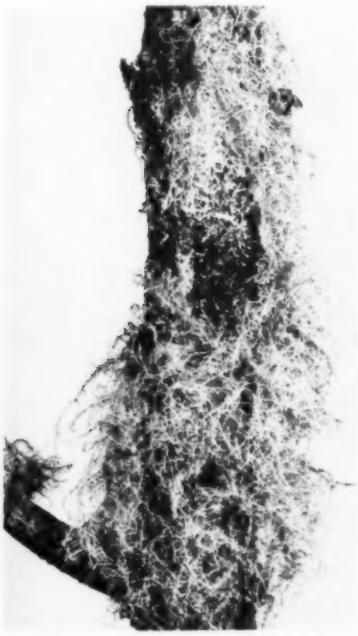
TWO SPECIES of Umbilicaria *(rock tripe) have become established on this boulder.*



OTS are the fruiting structures of a crustose



THERE ARE several kinds on this old rail fence. The large, sprawling fruticose lichen is Evernia. *On the right are numerous upright individuals of a* Cladonia. *Notice the ubiquitous* Parmelia *just right of center.*



This USNEA *is called old-man's-beard. In swampy places it may form hanging streamers several feet long.*

TWO SPECIES of Lobaria *are fighting for the same spot on the trunk of a 50-year-old ash tree.* L. amplissima *got there first but* L. pulmonaria *approves of the place also. Notice the tiny cuplike fruits of* L. amplissima.

close together. If attached to rock with no other organic matter present it is surely a lichen. When on bark or wood, they are merely attached to the surface and their tissues do not penetrate the wood to any depth as fungi do. Any discolored patches on trees and rocks are likely to be lichens. When on a hike, any gray, greenish gray or brown growths should be examined as possible lichens.

What time of year is best for a lichen field trip? One of the nice things about lichens is that they are found in excellent condition throughout the year. They appear the same in winter as in summer although those on the ground may be covered with snow. Of course, they are more easily seen during spring and fall when the light is good and the leaves are off the trees. In moist weather they are expanded, more colorful and thus more showy. Some are scarcely evident in dry air.

How may they be preserved and displayed? Lichens are among the easiest of all plants to preserve. They are easily dried and will keep indefinitely although the algae will die after a year or two in a dry dark place. A dried specimen when moistened will appear practically like the fresh plant. They do mold easily so should be dried rapidly although artificial heat is seldom necessary. They may be dried and soaked up dozens of times without harm. In professional collections they are usually flattened and filed in paper packets with labels that include rather complete data about locality, habitat and the like. For classroom use they may be dried in natural position and displayed in boxes. Some on tree bark make attractive displays if a portion of the trunk is taken. Serviceable display mounts are made using manila envelopes, pads of cotton, cardboard and transparent fireproof plastic. The plastic must be rather stiff; much heavier than cellophane. The cotton, cardboard and plastic are cut to size a bit smaller than the envelope. The cotton is placed on the cardboard, the lichen (flattened if necessary) placed on the cotton with a suitable label, this covered with the transparent sheet and the whole slid into the envelope which has been made open-faced with the assistance of a razor blade.

How many kinds in New York State? Of the approximately 2,200 species known for North America, a little over 400 have been found in the State of New York. A rough estimate for the world places the number at 20,000.

Do they harm the trees on which they grow? If they do, the effect is so slight that we have not been able to detect it. Certainly they do not decay the wood as fungi do.

Can any of them be eaten? Some are eaten but mostly as emergency foods only. The Iceland moss (*Cetraria islandica*) is used for soups and puddings in Iceland. In Norway and Sweden it is mixed with cereals and potato to make bread. Rock tripe (*Umbilicaria*) growing in the far north has been used by explorers when low on other food. It is scarcely palatable and likely to cause illness. Few lichens are believed to be poisonous but one (*Letharia vulpina*) has been used in northern Scandinavia to poison wolves. Dead carcasses were stuffed with a mixture of this lichen and powdered glass. It is said that the wounds caused by the glass make the internal organs very sensitive to the vulpinic acid in the lichen. This species is not found in New York State. In some of our western states sheep have been poisoned by eating large quantities of a paper lichen (*Parmelia*).

Do animals use them in any way? Yes. Especially deer which apparently

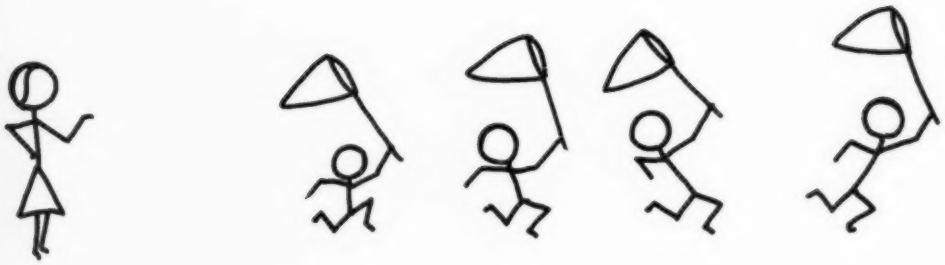
partake of all they can wrap their lips around. The caribou, and its Old World relation the reindeer, feed on species of *Cladonia* known as reindeer mosses. Icelanders and Scandinavians gather the Iceland moss for their horses, cows and pigs. Most lichens have bitter acids which deter some animals, but apparently many small creatures as insects and snails feed on them freely during damp weather. At least a few woodland creatures use lichens for building nests. Where the beard lichen (*Usnea*) is available, the parula warbler uses it to the exclusion of other materials. Some other birds and squirrels use various lichens in nest construction.

Do any have medicinal or other value? Few, if any, are being used for medicinal purposes today. During early attempts to find cures for the various ills that beset mankind it was believed that the Creator had scattered here and there on plants resemblances to parts of the human body indicating medicinal value. This was the "doctrine of signatures" which guided the herb doctors in the concoction of remedies. Thus *Lobaria pulmonaria*, whose lobes faintly resemble lung tissue, was used for chest complaints. *Peltigera canina*, with fruiting structures simulating dog's teeth, was the "cure" for hydrophobia. *Xanthoria parietina* being a yellow lichen was thought to cure jaundice. The long filaments of *Usnea barbata* were used to strengthen the hair. The doctrine reached the height of absurdity in the extravagant value set on any lichen found growing on human skulls; it would be used for epilepsy. Today, in our search for antibiotics, many of the lichens have been tested. About half of them contain chemicals that exhibit antibiotic properties but none has yet been found to compete with extracts from some other fungi.

Many commercial uses of lichens have been listed, including dyeing, tanning, brewing and extraction of oils for perfumery. Most products formerly obtained from lichens have now been replaced by synthetic materials. The purplish color in litmus paper, that turns red in acids and blue in alkalies, is made from one of the dye lichens, *Rocella tinctoria*. The principal value of lichens lies in their ability to invade and exist on bare rock; to them is allotted the pioneer work of breaking down the hard rock surfaces and preparing a soil on which more highly developed plants can grow.

These lowly plants, found nearly everywhere, easily studied, collected and preserved, should be better known by young naturalists. Their observation may develop into an enjoyable hobby.

CAREFULLY CHOSEN ROCKS bearing lichens make attractive bookends and paperweights.



Suggestions for Study of Insects

Ideas Offered Teachers To Instruct Children in Learning about Several Varieties

By
JOHN A. WILCOX
Curator of Entomology
New York State Museum and Science Service

INSECT STUDY HAS ITS HOST OF PROponents, from the amateur butterfly collector to the scientist doing research on the control of a pest which causes millions of dollars of damage each year. Somewhere in between are the teachers who use insects as examples to demonstrate many of the biological principles defined in elementary school natural history and high school general science or biology. Insects are numerous, varied in form and habit and are small enough to bring into the classroom where they can be watched more closely. Since they can be killed and preserved easily, it is not difficult to prepare a permanent collection. Most youngsters are familiar with some insects and with a little encouragement will show considerable interest in any directed study of them.

There are several reasons why insects have never been popular with teachers. There are so many different kinds and most of them are so small that identification is difficult. It is discouraging to have to tell an eager child that you don't know the name of the bug which he has brought to class. It might be well to explain that no one knows the names of all the insects in any area. Even the best trained scientists are familiar with only a relatively small percentage of the insect world. In fact, there are still many insects which have not been "discovered" and consequently have no names.

Every known insect has a scientific name which is used throughout the world for that one species. These names are written in Latin and are usually frightening to anyone but a biologist. Common names are easier to pronounce, are more intelligible to the novice and are satisfactory, in most cases, for the schoolchildren. Only a few insects have specific common names. However, these few constitute the most common or most

showy kinds. More often a common name applies to many related kinds. For example, there are over three hundred kinds of insects lumped under the name *ground beetle* in New York State.

The Little Golden Book, *Insects* by Zim and Cottam is one of the best for classroom use. It describes and illustrates the insects which are most likely to be found and can be used as a guide in insect study. Anyone who makes a serious effort in collecting insects is certain to capture kinds which are not included in this book. For the more interested student *The Field Book of Insects* by Lutz and *How To Know the Insects* by Jaques are recommended. Even these cannot provide identification for all our species but they can be used to name a remarkably large percentage of an amateur's collection.

Bugs in general are aesthetically displeasing to many people, and many people are afraid of being stung or bitten by them. There are a very few which will harm a person who handles them. These include wasps, hornets, bees, waterbugs, kissing bugs, three or four fuzzy caterpillars and the black widow spider. All the rest are harmless to the collector.

A field trip can often make a subject exciting when classroom discussion and demonstration fall dead. Active participation and a chance for each one to find something different often engenders interest in the most unlikely pupil. However, in order to make a field trip more than just a picnic, a little planning and preparation are necessary. Of course the leader should have visited the trip destination to know what to expect. Also, the date should be tentative so the weather can be taken into account. A wet trip will offer little more than wet feet.

Those going on the trip should be given enough preliminary instruction so they will know where and why they are going, what to look for at the destination and how to collect specimens and record observations. A bug-hunting expedition requires collecting jars and perhaps nets which must be prepared before trip time. A few items of equipment are necessary for collecting insects. Two types of nets: one with the bag made of lightweight netting or marquisette for flying insects and a beating net with a heavy, muslin bag for " sweeping " through foliage. The latter is useful for collecting insects which may be hiding on the plants. There are all-purpose nets on the market which combine the desired characteristics of these two; however, these must be handled carefully or they will not last. Each student should be provided with a collecting jar. Most adult (winged) insects and especially butterflies and flies should be killed in a jar prepared by putting a half-inch of plaster of paris in the bottom. When this is dry the jar can be charged by saturating the plaster with ethyl acetate or carbon tetrachloride. Spiders and soft-bodied insects such as caterpillars and aphids must be preserved in alcohol. Rubbing alcohol (isopropyl) will do but 70 percent ethyl alcohol is, in some ways, better. Remember, also, to bring some of the insects back alive for a classroom zoo. A hand lens for each student is useful in observing some of the smaller insects.

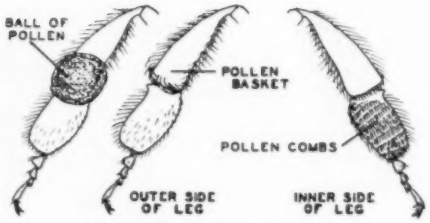
In order to make the trip most profitable it is best to concentrate the hunting on a small number of types of bugs. These are ones which are most likely to be found or which best demonstrate some particular point we wish to make. Of course no insect is protected by law but as soon as more promiscuous collecting is permitted, the problem of identification becomes critical for the teacher who has not had special training in entomology. The goldenrod field trip described below is an example which has proved successful.

Although insects can be found almost anywhere and at all times during the year, one of the most productive is an early fall excursion to a meadow in which goldenrod is growing in profusion. This is a common situation and in it one can find rather large numbers and many kinds of insects. Here, also, the teacher can predict with more confidence that certain insects will be found. These few can be studied before the trip so field identification will be easier. During other parts of the year or in other situations, insects are more scattered and one cannot as accurately predict what will be found.

When in the field on our "goldenrod trip" look for the following insects. These are described in Zim and Cottam's insect book. Most of them are more or less familiar but it is well to look at the illustrations and descriptions again, keeping in mind the questions of where they are found normally, how their life and habits are related to other animals and to the plants on which they are found, their defensive adaptations, what they eat, and how they are adapted for obtaining food.

AN AMBUSH BUG viewed from the side. Note the grasping front legs and the piercing, sucking mouth parts.

1. *Ambush bug.* Observe how well the color and irregular shape blend with flowers on which the bug lives. Note the form of the front legs and how they are well adapted to capturing other insects on which it feeds. It can capture such large insects as butterflies and bees.



THE HIND LEGS of a honey bee have pollen combs which the bee uses to form pollen, mixed with a little nectar, into balls. The ball of pollen is fastened to the outer side of the leg in a "basket" of long hairs.

2. *Bees, hornets and wasps.* These insects can sting, so be careful. Capture them by placing the collecting jar over them when they are in the net. They make no effort to hide nor do their colors camouflage them. Birds soon learn to recognize them and leave them alone. The legs of bees are modified, as shown in the accompanying illustration, to collect and carry pollen to the nest.

3. *Grasshoppers and katydids.* These insects are well camouflaged. The coloration of grasshoppers is like the grass and that of the katydids similar to the leaves on which they live. Note that the grasshoppers usually rest on the ground while the katydid more often clings to the high parts of meadow weeds. Observe the strong, swollen legs which are used in jumping away from danger. Examine the mouth of a grasshopper, notice the side-to-side chewing jaws. How do these parts compare with those of an ambush bug or stink bug?

4. *Stink bugs.* Many of these, sometimes called shield bugs, feed on other insects, others on plant juices. Their mouth parts are like a long slender tube which they insert into the plant or insect and through which they feed on the liquids within. Many of these insects

have an extremely disagreeable odor (and taste) which protects them from bird and mammal predators.

5. *Aphids or plant lice.* Aphids may occur in colonies of enormous numbers. They have few obvious methods of protection. To a certain extent survival of the species lies in the fact that they give birth to large numbers of living young. Ants often tend them and act as protectors. Aphids secrete a substance called honeydew which the ants like.

6. *Lady beetles.* These are the chief enemies of aphids. They eat large numbers of aphids during the warm part of the year. Both adult beetles and their larvae may be found during late summer.

7. *Butterflies.* The butterflies are the most easily seen because of their large size, but the irregularity of their flight makes capture difficult. They obtain some nourishment from nectar of the flowers. Watch the actions of a butterfly on a flower. If you can get close enough, observe the hollow, thread-like "tongue." This is tightly coiled when not in use.

8. *Spiders.* A number of different kinds of spiders will be seen. Note particularly the large golden garden spider, *Argiope,* which captures its prey in a web net and the crab spider, *Misumena,* which hides in the flowers and captures its prey by stealth.

9. *Plant galls.* These are growths which the plant produces as a result of some chemical stimulation by an insect. The ball gall on the goldenrod stem houses the maggot of a picture-winged fly. The maggot obtains food from the plant juices. Cut into a gall with a knife and observe the fly larva.

10. *Blister beetles and leaf beetles.* Beetles often do considerable feeding on goldenrod leaves. When disturbed they fold their legs and drop to the ground, where they "play possum" until danger has passed. The oil beetle derives its name from a blistering substance which is disagreeable to predators.

11. *Caterpillars.* A few caterpillars remain active and feed until cold weather induces them to seek a protected place to spend the winter. Some of these are hard to find because their color is similar to that of the part of the plant on which they feed. Others gain some protection from their enemies by the long hairs covering their bodies. Birds usually will not eat fuzzy caterpillars.

Laboratory work following the field trip should include mounting and labeling the captured specimens, identifying them and summarizing the observations made in the field. Specimens killed in alcohol may be preserved in that fluid indefinitely but those killed by fumes in killing jars must be pinned, spread and dried. Methods of collecting and preserving insects are described in *Collection and Preservation of Insects* by Oman and Cushman, and in *How To Know the Insects* by Jaques. All specimens collected may be incorporated in a class collection. However, frequently a student will become interested in insect collecting as a hobby so specimens collected by that individual can be returned to him after the class is through using them.

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NATURAL STANDS of young pine such as this respond well to conservative forest management.

Arbor Day Honors New Yorker

Jay Sterling Morton Began Observance in Nebraska Three-Quarters of a Century Ago

By
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THIS APRIL WE HONOR A NATIVE OF New York State, Jay Sterling Morton. For it was he who, 75 years ago, as Governor of Nebraska, decreed the first Arbor Day. Few people today know whether the tree that Governor Morton planted survived and grew to maturity or whether it was stricken by the dry Nebraska winds. But every schoolchild does know that the *idea* that Governor Morton planted has lived in the minds of men from that day to this.

Arbor Day in fact owes much of its popularity to schoolchildren and their teachers. It has been the teachers who arouse in their pupils an appreciation of trees and a desire to participate in planting them. It is the teachers, also, who point out the significance of performing acts today that will enable us to reap returns tomorrow. It is the teachers who plant ideas in young minds that grow to fruition as the child matures. This Arbor Day message is directed mainly to teachers. Its title comes from a great teacher of foresters, Carl Alvin Schenk, the founder of the Biltmore Forest School.

It is worthy of note that Arbor Day originated in Nebraska where trees are restricted mainly to watercourses and shelterbelts planted by man. Planting a tree in Nebraska is a more significant act than planting one in New York State where trees spring up naturally from seed scattered everywhere by the wind. In our State millions of tree seedlings perish each year because they start to grow on lawns, pastures, fields, roadways and other unsuitable places. This fact does not detract in the least from the importance of Arbor Day but it does serve to introduce a new concept of its importance.

It was just two years after Governor Morton proclaimed the first Arbor Day that Franklin B. Hough, a native of Lowville, New York, induced the American Association for the Advancement of Science to memorialize Congress on the need for proper care and management of our country's forest resources. Congress reacted favorably and Mr. Hough became the first paid Federal officer to devote his full time to forestry.

The idea planted by Hough has given real breadth and significance to Arbor Day for it now symbolizes respect for all the values and services that trees provide man. Hough's idea was nourished and brought to fruition by the work of Theodore Roosevelt, Gifford Pinchot, and later by such able foresters as Graves, Greeley, Stuart, Silcox, Clapp, Watts and McArdle.

Today we have in the United States a huge forestry movement embracing activities by the Federal Government, the several States and territories, many counties and municipalities, and a rapidly growing number of pulp and paper companies, lumber companies, railways, associations and individual forest landowners. Mr. Hough's idea now absorbs the talents of some 17,000 trained foresters. It is championed by over 1,000 public and private organizations of many sorts, including Boy and Girl Scouts, and 4-H Clubs.

A new idea is taking form on the forestry scene. The old idea might be characterized as planting a tree for posterity. The new idea is establishing a forest for self and family. A few weeks ago, it was my privilege to discuss intimately the future outlook in forestry with four men probably in the best position of any to understand the significance of current happenings. These men were the president of the American Forestry Association, the president and the executive secretary of the Society of American Foresters and the chief of the U. S. Forest Service. The private words of the last-named were particularly expressive. "I am happy that I became a forester," he said. "I am even happier that two of my own sons are foresters. I became a public forest officer because other opportunities scarcely existed when I entered the profession. Today, foresters have many opportunities, and maybe best of all the chance to own and manage their own land just as a farmer does. I am convinced that the satisfactions that come from practicing forestry on one's own land would be enormous, and I believe that the remuneration would be adequate or even generous."

THE SUGAR MAPLE familiar along roadside and in forest is our official New York State Tree.

The idea that needs to be planted today in the minds of young folks and old folks alike is that growing trees on forest land can be a way of making a living and a good way at that. Let me cite just a few specific examples.

Fourteen years ago a man, then 70 years old, retired after 36 years of service as a State forester. For the first time in his life he began buying forest land for himself. The land he bought was cutover land that banks and lumber companies no longer wanted. He planted no trees. Nature had already planted them for him. He simply acquired the land, cared for it and permitted the trees to grow. This man, now 84 years old, is still active and getting the greatest thrill out of life he has ever had. Why? Because on the land he owns his trees are growing under his own forestry care. He is applying the principles and practices he has sought to have others apply throughout his State. His venture has been a success financially. In these 14 years, he has made a modest fortune. But it is not the fortune that interests him. Rather it is the demonstration that private forestry provides a good way of life and appropriate financial rewards.

This man is not unique. Another started in 1929, acquiring tax delinquent cutover land. Meeting tax and other payments was a major problem for him at the beginning. Some 20 years later, he owned 25,000 acres and set up his own logging operations. Later he sold his land to a large pulp and paper company and started acquiring land over again. Two other men prominent in government and private forestry, and one a former

chief forester, both started buying forest land after reaching retirement age. They, too, report deep satisfaction in the chance to watch their own timber grow.

Many other foresters have likewise acquired forest land as a modest family investment and found it to be a valuable one. For some it has become the chief way of winning a livelihood.

To follow in the footsteps of these men is not easy. Foresight, planning, attention to current needs and skillful management and merchandising are required to operate any business successfully. So is the knowledge of pertinent technical information. Certainly no man acquainted with the facts would urge tradespeople, mechanics, school teachers or even farmers to invest their savings in forest land without competent technical advice and continuous professional service from a skilled forester. That some uninformed individuals have made out well is of no more significance than that some amateurs have been lucky in stock market speculation. Without understanding timber growth rates, soil quality, values of logs and standing timber, and the many other details that make up the working knowledge of professional foresters, the risk of loss of investment is high.

The idea that needs to be planted and nourished today is that skillful management of forests, or more simply stated, tree farming pays in esteem of neighbors, pays in future products for the Nation and pays in dollars and cents to the owner and his children. At no time in our country's history could forest ownership have been undertaken with as high opportunities for technical and financial success as today. It offers to boys in high school a new career outlet. They can embrace the opportunity to develop properties that will grow in value with the years under their own care and effort.

The requirements for success are interest in growing things, education in a forestry college, willingness to start modestly and work hard while building up a property, and faith in the future of the forest and our country.

The opportunities for young men educated in forestry to become independent

PLANTED PINE TREES 30 years old growing on abandoned farmland. Some trees have been harvested and sold to afford faster growth of remaining trees.

forest land owners has been purposely stressed because they are so large and so little realized today. It would be giving a one-sided impression, however, to close this paper without mentioning the rapidly expanding opportunities in public and industrial forestry. The same economic factors that make forestry pay for the individual makes it pay also on State and National forests and industrial holdings. Many attractive positions such as watershed management, forest research, park management and wildlife management, to name but four, are destined to remain largely in the public service. These fields of employment also offer rich satisfactions, varied experience and contact with the ablest foresters of our country.

And so this Arbor Day, as we plant a tree in the school ground, or in the field or forest, let us plant in our minds the idea that forests are worthwhile to our country, to our State, and to you and me. And as this idea grows, the forests of our State and Nation will become benefactors of mankind to an extent never before realized in America. For forests are far more than a grove of trees. Forests are, in a sense, living organisms in themselves in that trees mutually support one another. They also provide shade and soil conditions favorable to the growth of forest herbs. They provide a home for wildlife, build up the soil, store water and provide recreation for mankind.

When man cultivates a forest, he is producing not only crops of timber, but crops of wildlife, crops of water, and recreation for man. These may well exceed the total monetary value to be derived from the logs and other timber products he sells.

May we this Arbor Day honor Governor Morton. But let us also remember Mr. Hough and the work he started that has led to care of our Nation's forests. Let us also realize that despite the great momentum of forestry in our country, the work ahead is vastly greater than that behind. Let us, as a people, rededicate our efforts towards making our forests of high service to man.

Arbor Day Ceremonies of a Dansville School

ELEMENTARY SCHOOL
children plant
a tree

Facts on Deer in New York State

Too Many of Antlered Natives?—Study of Deer Populations Suggests Answers

TOO MANY DEER? WHY SHOULD A question of this nature be asked about this splendid wild resident of our woods and meadows? There are never enough deer for hunting enthusiasts — nor for those whose only interest is in observing them in nature. There must be other points of view which stimulate this question and indeed there are — from the orchardist, the truck gardener, the farmers whose crops are trampled and eaten by "too many deer."

By
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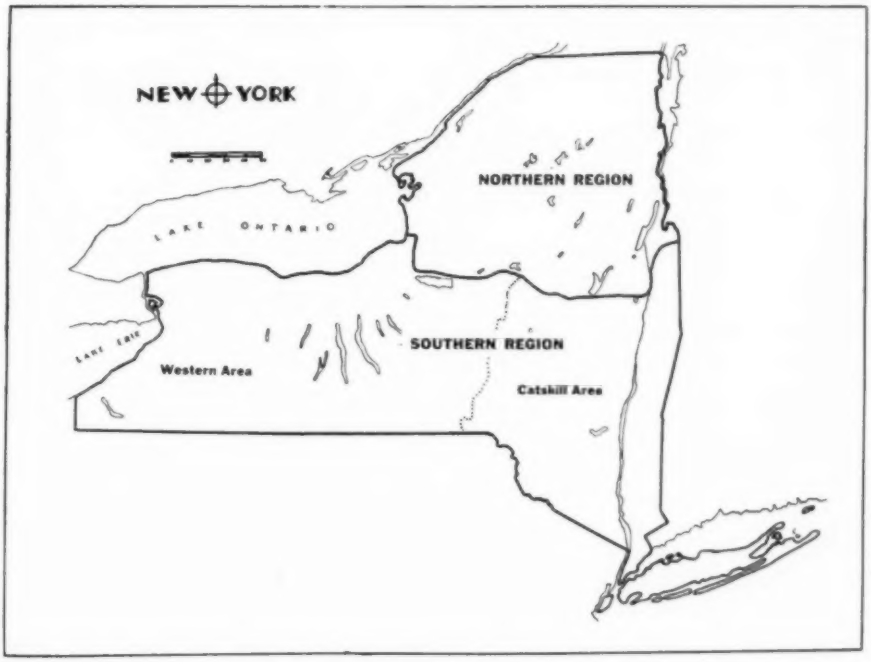
For several decades, thriving populations of the white-tailed deer have brought great recreational pleasure to millions of people, and grievous consequences to



MAP showing major regions and areas mentioned in the text. Boundary separating northern and southern region has been subject to minor shifts but not great enough to affect importantly the regional deer kills reported here.

DEER AND AGRICULTURE: 23 deer as seen from the air in agricultural country in the Lake Plains.

many landowners whose livelihood has been adversely affected by them. The management of these populations consequently has become one of the most controversial subjects confronting State conservation departments. New York State is no exception.

Vital statistics can be very dry reading, but unless we understand some of them as they relate to the question before us, we are in no position to grasp its scope. What is a reasonable estimate of the total number of deer in New York — how many adult does and bucks —how many fawns are born each year? What is their average life expectancy? How many are taken by hunters? From results of nearly 20 years of intensive research we are able to answer these questions with sufficient accuracy and confidence to put them to work in recommending management measures designed to control the size of those herds which are growing too large, either for tolerance of the landowner, or for welfare of deer themselves where they are destroying their own natural food supplies. Yes, there can be too many deer.

Our best estimate of total deer numbers in New York State runs from 350–450,000. This is derived in large part from annual deer kill statistics and their distribution, and general knowledge of deer numbers per square mile of range to be found in each county occupied by deer. If we accept the figure 400,000, chances are no one will quarrel seriously with us.

Among our approximate 400,000 deer the sex ratio of adults varies between regions of the State depending upon the intensity of annual buck hunting. Thus in the southern part of the State below the north-south zone line (see map) the deer herds are easily accessible because of the dense network of roads. In this large area the sex ratio averages about 100

bucks to 200–300 adult does, a direct result of high, annual buck hunting pressure. In the northern Adirondack region, and particularly within the Adirondack Park " blue line," access to the deer herds is difficult, roads are few, and only a comparatively few hunters venture back into these wilderness areas. Here the sex ratio of adult deer is about 100 bucks to 130 does.

How many fawns are born each year to this great herd of deer? We have found that this too varies by regions, and that aside from the obvious influence of the numbers of does, the kind, quality and amounts of natural deer food available have a profound influence on the birth rates. In the southern region as a whole 100 adult does will annually bear about 170 fawns and adding to these will be another 30–40 fawns for every 100 yearling does which mated when only seven or eight months old! In the northern region 100 adult does can be expected to produce about 120 fawns annually and only rarely will a yearling doe add to this number. Thus from our herd of 400,000 deer we can expect each spring and early summer from 200–225,000 offspring to be cached away and vigilantly guarded. Since the largest proportion of our does mate in November and the gestation period averages about 200 days, the majority of these little, spotted new arrivals appear from mid-May to mid-June.

The average life expectancy of deer is amazingly short. Since having learned how to tell accurately their age from examining the stage of tooth replacement and tooth wear, we are now able to construct a kind of actuarial table much as life insurance companies do when calculating their financial risks insuring human lives. Though we don't insure our deer financially, we can insure them against facing too heavy odds from man's exploitation. This we do through governing hunting seasons, bag limits, providing certain protections from dogs, and from good people who find it difficult to refrain from " saving " a supposedly abandoned fawn. We have found through analyzing the age composition of thousands of deer that the average buck in the southern region has a life expectancy of 1.9 years, the average doe about 2.6 years. In the northern region the average buck can expect to live about 2.6 years, doe about three. It is unusual to find a buck older than five years in the southern counties whereas it is not at all uncommon to find deer 10 years or older in the Adirondack Mountains.

There used to be great concern about the effects of deer hunting on survival of our deer. As a matter of fact, the strict protective laws enacted near the turn of the century were largely instrumental in allowing the deer's reestablishment and spread throughout range suitable to it in southern New York. Here it was nearly exterminated in the 1800's, and was rare even in the Catskill Mountains. Extensive lumbering also was of vital importance in the resurgence of deer because new brush growth developed in its wake and provided an abundance of succulent food. It is still an important factor in permitting the present level of deer abundance. After all, it takes six to eight pounds of good food each day of the year to nourish the average deer adequately. This is well over a ton per year and considering the finicky eating habits of this fellow, one can see that between mother nature and man, the provision of 400 to 600,000 tons of deer food each year is not an inconsiderable task!

Due to the legal provisions for requiring the reporting of each deer taken in the State, we have a quite accurate record of the impact of hunting seasons on deer in every county in which deer can be legally hunted in one way or another. For example, in 1928 with a 31-day

A FAWN in the last stage of winter starvation, found in the Adirondacks

season in the Adirondacks or northern region there were 5,997 bucks reported. From the 15-day season in the southern region when all counties were open there were 1,050 bucks reported. Twenty-five years later (1953) with a 37-day season in the Adirondacks there were 7,340 bucks reported. From the 26 counties west of the Catskills with 6 days, and 14 counties in the Catskill area with 16 days, the reported buck kill was 15,017. In 1955, season similar to 1953, 7,778 bucks were reported from the Adirondacks. From the south came reports of 25,161 bucks, 14,017 from the 26 western counties which had a 12-day season and 11,144 from the Catskill counties which had a 16-day season.

From this it can be easily seen that our buck hunting carries no threat to survival of the State's burgeoning deer herds. As a matter of fact, since the deer is a polygamous animal, and considering the tremendous annual replenishment of fawns (birth ratio of 106 males to 100 females) it is impossible to curtail growth of deer populations through buck hunting alone. For this reason the Conservation Department declares special seasons at periodic intervals during which hunters may take a deer of either sex. This type of season was first introduced in Steuben County in 1941. It was brought about by acute, growing conflict between the rapidly expanding deer population in the southern counties and the economic interests of agriculturists. The simple fact was that there were too many deer — too many for *friendly* compatability with the farmer! The buck law had become outmoded — but it was hard to convince the great majority of the public who had been so completely sold on the immutability of the buck law as the one sound principle of deer conservation.

But what of deer populations where their conflict with agricultural interests are of much less significance? This brings us to another point which will be understood by all thoughtful students of living things. Every animal or plant is a product of its environment. All of its requirements for life are there. Every species has its particular niche in the environment and this is called its habitat. Every habitat or niche has limitations in its capacity to support populations of any given species. This limit is known to wildlife biologists as maximum carrying capacity and it is the tendency of every species to grow in numbers beyond that carrying capacity. In the case of deer, particularly in the northern States and Canada, the big, natural bottleneck to maximum carrying capacity of deer habitat is the wintering range where they tend to concentrate for shelter and food. In the Adirondacks and parts of the Catskills, cold weather and accumulations of snow cause deer to concentrate in large numbers. Deep snow may result in their being so confined that movement is limited only to a network of trails. Being

unable to leave these trails, their food is restricted to what they can reach from the trail side or by standing on their hind legs and stretching to reach the overhanging boughs. This wintering range may consist of only 10 to 20 percent of the total area over which they feed and rest during the remainder of the year. But the qualitative as well as quantitative limits of food in this restricted wintering area is the major condition influencing and even controlling deer abundance throughout its total summer and fall range. Starvation may become the great leveler, and the overburdened winter food plants, annually browsed back by hungry deer have little chance for recovery. The surviving deer are in poor condition come spring. Antler development of the yearling bucks is of generally poor quality, the does produce fewer fawns and fawn growth is retarded. The result is a decadent population struggling to survive on a subsistence diet with little hope of improvement. Too many deer? Yes, and when too many deer were developing, leading to deterioration of the natural range, none of man's economic toes were being stepped on — so there was no outcry.

We are pitifully ignorant of nature's laws. All too frequently we try to lock the barn after the horse is stolen. For years we heard voices clamoring to save the starving deer, and the same voices protesting loudly and vehemently any measures designed to legitimately harvest the surplus populations and control deer numbers to within a reasonable balance with the carrying capacity of their winter range. Had there been privately owned, young plantations of pine, cedar and hemlock in these problem deer ranges, there is little doubt that we would have heard the protests in time. But the ears are few indeed that are turned to hear and understand the dumb, silent protests of these deer herds approaching the brink of range disaster. Only deer are the principals in this hardship.

Are there too many deer? The answers are as many and varied as are the respondent's particular interests and experience. We do know we have a great and important natural resource in our deer which is endowed with large, annual regenerating power. Our problem is to use it wisely — to avoid wasting it, and above all to protect and perpetuate the environment of which it is a product.

DEER TRAILS in the deep snow of the north woods, showing heavily overbrowsed food plants in the trail network

Our Sanctuaries

Biological Preserves Maintain Life for Future Use

By
STANLEY J. SMITH
Curator of Botany
New York State Museum and Science Service

THE SHOWY LADYSLIPPER makes the pockets about Mud Lake, Jordanville, Herkimer County, special.

IN THIS DAY, MUCH IS SAID ABOUT VARIous kinds of sanctuaries — religious, historical and biological. We are here concerned with the last sort. I propose to set forth a few thoughts on such sanctuaries and their value.

Teachers of conservation and nature study have a prime interest in maintaining biological preserves. They are the best places for demonstration of life cycles, seasonal responses, native resources and the relation of these to life and culture. Other teachers should be interested in them as subject-material and object-material for themes, artwork, history and geography.

First, let us define the meaning of the word, "sanctuary." In the dictionary, we find two definitions: (1) *a consecrated place, as one devoted to the keeping of sacred things;* (2) *a sacred and inviolable asylum; a place of refuge and protection.* In these two definitions lies an important difference.

We can maintain a small acreage of woodland on our property and grow thereon interesting native plants, removing them from other areas where they are common or from spots where they are in danger of destruction. Also, we can plant species attractive to birds and offer other necessities to the birds and develop a haven for them. These are sanctuaries in the first sense and are certainly most useful.

The setting aside of areas which cannot be altered under any circumstances organizes sanctuaries in the second sense. Since the emphasis of this bulletin is preservation of wildlife and since wildlife in its total is best maintained where there is no interference with natural interactions, we shall discuss the value of this type in more detail.

These values fall into several categories: historical, aesthetic, scientific, educational, preservational, spiritual. Each deserves a fuller statement. The references to organism are primarily botanical, because I happen to be a botanist.

One of the important reasons for preserving undisturbed areas is that they represent a part of the history of the State as surely as do Indian pottery and the remains of colonial forts. In these

lands and waters occur the plants and animals with which the Indians lived and out of which they fashioned much of their culture. From the white-tailed deer they had meat, hides and bones for utensils; from the brook trout, food; the leafcup, medicine; the paper birch, canoes and utensils; the white elm, material for constructing houses. Into this land came the colonists, finding those organisms and many more: the beaver on which depended so much of the early history of New York State, the white pine from which countless homes and ships were constructed, witch hazel for medicine, the fox grape for food and drink.

These items, all together, with other plants and animals in the area, decided the culture of the Indians and influenced that of the European colonists. Wars were fought over control of the fur trade. These forms of life are here for all to study and relate to the written accounts. These plants and animals are permanent illustrations of part of the basis of our civilization and those that have gone before it. Properly handled, they will remain for centuries.

Aesthetics (the philosophy of beauty) is a word about which some of us prefer to remain silent. Yet, one philosopher has defined beauty as truth which one has made part of himself so that the personality is made richer by the process. Most of us are interested in aesthetics from such a definition.

THIS GLACIAL PLUNGE-BASIN near Jamesville, Onondaga County, was called an extinct crater by the eccentric scientist, Rafinesque.

Beauty exists to be found in many ways in natural areas. Some admire the grand sweep of the landscapes in the higher parts of the Adirondacks. One can sit on top of Mt. Marcy and admire the view for miles around with the lakes and ponds

IN THE VARIED terrain around Junius Ponds, Seneca County, occur forms from many of the classes of living things.

scattered about, the interlacing of slides and hardwoods and conifers on the slopes and in the valleys, an occasional hawk wheeling in the foreground.

All of us have limited areas, the private "precious spots" which are known only to us and a few friends. For me, one of these is Indian Pass at the foot of Mt. Wallface, where the great boulders fallen from the cliff insulate the snow in the caves beneath them and the cool moist habitat maintains some rare flowering plants at their only stations in New York State, and northern mosses abound. Others derive their glimpses of beauty from individual items: the black and red of the scarlet tanager, the delicate loveliness of a flying squirrel, the jeweled teeth of a moss fruit, the purple and white pluming of the groundsel tree in the salt marshes, or the rose-colored teeth of a small hedgehog fungus on the underside of a rotten log. In natural areas, one finds all three kinds of beauty.

The scientific aspects are important, too. Somewhere in New York State one can find representatives of most of the recognized classes of living things. In unaltered areas, these organisms can reproduce themselves unhindered and contribute their part to nature. Some of them are so closely linked to others by parasitism or food habits or by the requirements of peculiar habitats that the removal of one organism leads to the decline of others. The dependence of parasites on hosts is obvious, but few except professional foresters realize the requirements of moss blankets for natural reproduction in the spruces or of fallen leaves to sprouting of bloodroot seeds.

For the study of continuing ecological changes, biological sanctuaries are unexcelled. Here, research done at intervals and maintained over long periods (centuries?) would solve many secrets of biology. Further, since progress demands investigation and since investigation demands experiments in changing of natural situations, undisturbed sanctuaries afford ideal control areas for comparison. From the standpoint of pure knowledge alone, we need to maintain all the forms possible in their natural habitats and to study the relations of these forms to each other in small numbers and in large over long periods, but the requirement of unaltered areas for checking is absolute.

The maintenance of biological preserves expands our educational facilities. The opportunities for teaching natural history in such areas are unequaled. With proper accounts of flora and fauna (both lists and descriptions), supplemented by

studies of climate, soils, drainage and geology, one can teach whole courses in nature sanctuaries.

On our mountains, we can trace the advance of spring in the development of plant life up the slopes. In a single day, we can take a class backward from spring to winter, showing the relation of seasonal development to elevation. Although noticeable elsewhere, it is most striking where the flora is sufficiently undisturbed that the commoner species occur for the entire distance of the climb. We can show altitudinal belts of forest climaxes and their correlation with various species of animals, as the notable zoning of species of wood thrush on the slopes of Slide Mountain.

Relation of food to user is everywhere. The activities of predator and prey can be studied in natural habitats. Effects of overbrowsing can be seen as on the Moose River Plains where the deer control the aspects of the scrubby shrub growth over a wide area. Life cycles of many-phased species can be observed under natural conditions. (For instance, one of our frequent rusts has its perfect stage on the common touch-me-not or jewelweed; the full cycle can be seen in this State only in a few spots in the Catskills where the alternate host, the moschatel, survives.) The invasion of temporarily denuded gravel bars, slides and upturned tree roots and the disintegration of dead materials as carcasses and logs are easy to see. Finally, with abundant illustrative material, classification comes alive and studies of variability, differentiation and adaptation take on new meaning.

The preservational aspect is twofold. Setting up the sanctuary as an unaltered area preserves the species therein. It may well preserve us. Maintenance of natural conditions allows the vegetation to approach the natural climax for the area, developing a richer soil and an improved water table. It also preserves particular species and varieties against the day of discovery of new uses.

In this age of wholesale investigation, one need but think of the vast series of antibiotics. As each new antibiotic is discovered, the whole range of its relatives is then surveyed. Some of the members of an alliance may survive only in these preserves of ours and these survivors may be the very best of all for one purpose or another. The preserved colonies are then sources of reproductive material.

The importance of certain molds, as the source of the drug, penicillin, is now firmly established; it has recently been suggested that one of them may provide

ADAPTATION to dune sands is easy around Woodville, Jefferson County.

THE BEAUTIFUL WHITE TRILLIUM, abundant near Erin, Chemung County, possible source of new medicines.

a cure for chestnut blight. The wild mandrake contains a principle which is being studied as a possbile control for cancer. I have received questions about one of our native species of lettuce and a wild sweet pea in connection with breeding experiments for improving disease resistance in garden lettuces and peas. Any one of our native plants or animals may some day prove to be the very one we need for improving or preserving our way of life.

The final advantages of sanctuaries which I shall list are spiritual. Basically, western civilization is linked to monotheistic religions. It is obvious that these religions arose in an area where people had the space and time to think. Early planners in our National Capitol, Washington, intended that the city should be dotted with parks and latticed with parkways so that, in the entire city, nobody would need more than a few minutes to walk to an area screened from the busy life of the streets.

The advantage is clear. Most people can think better where they are not interrupted. In the midst of natural surroundings, one can think of life and civilization and eternity. The whole of earthly existence goes on; short cycles repeat and long cycles can be plotted by comparison. Death is sudden or death is slow, but the result of death is life for the other members of the community and the life of the species continues. It is this sense of continuity that is important and revealing. As noted above, the preservational aspects may preserve us physically; the spiritual aspects may preserve us morally.

Each of these six categories is reason in itself for maintaining certain areas as undisturbed sanctuaries without hindering or helping processes inside. Some of these areas would necessarily be small, since they would represent all we have left of certain types of biological communities. Others should be set up on as large a basis as possible, since the balance of all factors concerned in a region is unquestionably influenced near the margins by altered conditions outside. We owe it to ourselves and our offspring. It is a project in which individuals, groups and the State can all share.

Acknowledgment

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Ruby-throated Hummingbird

THIS IS THE ONLY HUMMER THROUGHout most of its breeding range (see map). Because we are accustomed to think of it as *our* smallest bird, we tend to lose sight of the fact that — compared with many species of the American tropics — it is rather good sized as hummingbirds go. No wonder that early explorers were much impressed by the marvelous flight and appearance of these tiny birds, which occur only in the Americas!

On leaving the winter range, many rubythroats cross the Gulf of Mexico. It has been calculated that an individual weighing three grams (28.4 gms. = 1 oz.), cruising between 30 and 40 m.p.h. and barring adverse winds, can fly 500 miles nonstop. The bird would use one gram of fat for "fuel." Wingbeats per second are about 55 when hovering, 61 when backing and up to 75 in straightaway flight.

The first arrivals in southern New York are seen by mid-April some years, but more commonly about the 25th. Usually the species occurs throughout the State the first week of May. Early birds have survived short periods of cold weather. In fact, it is normal for the hummer to have lower temperature and metabolic rate at night, in order not to use up its "fuel supply" before it can feed the next morning. Migration ends by early June.

The male's usual display is a "pendulum flight" — he flies back and forth in an arc of about 8-foot diameter. His tail is spread fully and he utters a series of thin squeaks. The female is a few feet away, perched or feeding.

The nest generally is saddled to a small sloping limb, where it has the appearance of a mossy knot; usually it is 5 to 50 feet above ground and sheltered by a canopy of foliage. Bud scales, plant down, spider web and lichens are major items used in construction. The pieces are held together by bits of web and, evidently, saliva of the female, who ordinarily does all the building. Nest height is about $1\frac{3}{8}$ and diameter $1\frac{3}{4}$ inches; inside diameter is about $1\frac{1}{4}$ inches and depth nearly an inch.

The female works on the nest for about a week, then lays the first tiny white egg; the male's association with the female ends by this time. A day later the second egg is laid and the 17-day incubation period begins. Work continues on the nest through this span, even later, sometimes. The chicks are hatched naked and have relatively short bills, but grow so large that they sit on top, rather than in, the nest; the female feeds them. They practice flapping their wings only at times during the last day or so of the 18–25 day period before making their initial flight.

The nesting cycle, therefore, requires 6 to 7 weeks. The female usually builds another nest, at another site and in shorter time, and a second brood is raised. This carries reproductive activities of some individuals well into the period when fall dispersal of others has begun.

The main food of the hummer is insects, not nectar. Besides getting food from flowers, they have been seen catching insects on the wing. Numerous observers have seen them drinking and feeding at sapsucker feeding holes in orchard and woodland trees.

By mid-August, at least part of the population is on the move. At this season the usually solitary hummer frequently occurs in numbers at especially good feeding places — such as patches of jewelweed. Migration is in full swing during the first half of September and by the end of the month the last one usually has departed.

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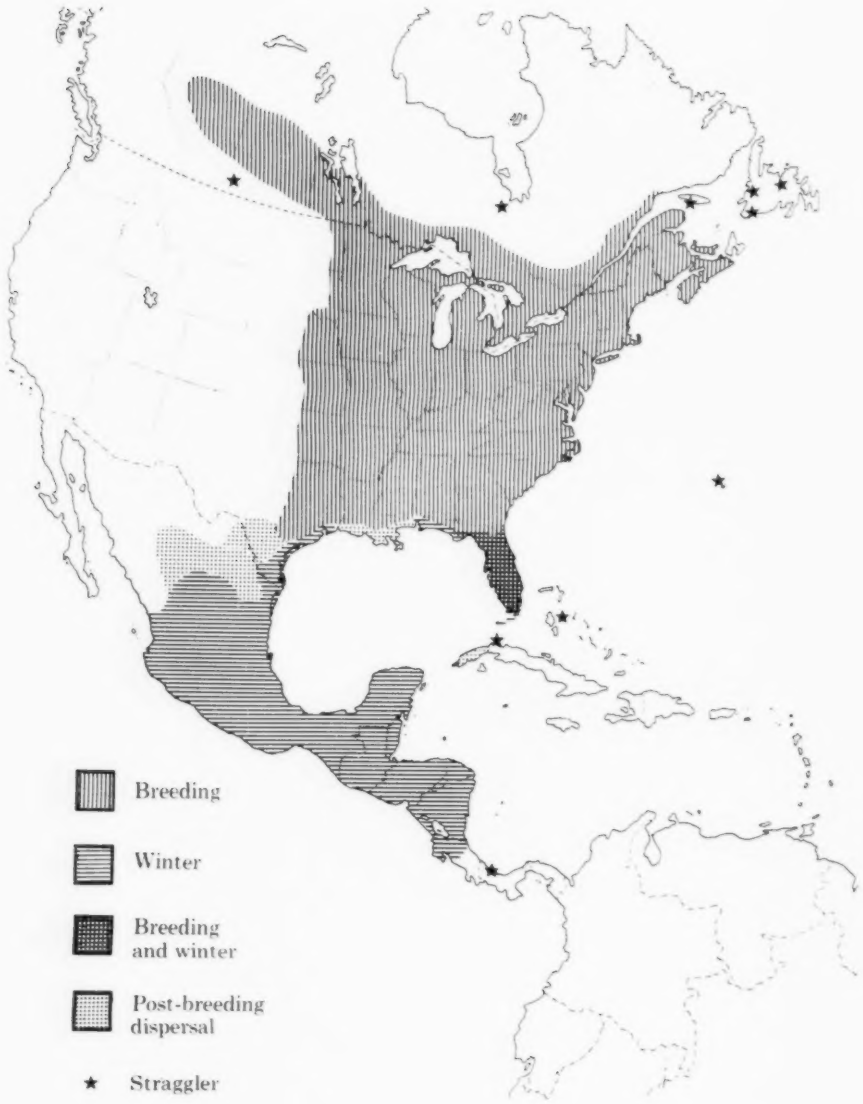

Range of Ruby-throated Hummingbird (*Archilochus colubris*)

This species occasionally may winter farther north than shown on the map. Perhaps it also winters in the "postbreeding dispersal" areas shown. The star in the Atlantic Ocean is for several occurrences in the Bermudas. Omitted is the record of a mummified specimen picked up on a beach near St. Michael, Alaska. Map by E. M. Reilly, Jr.